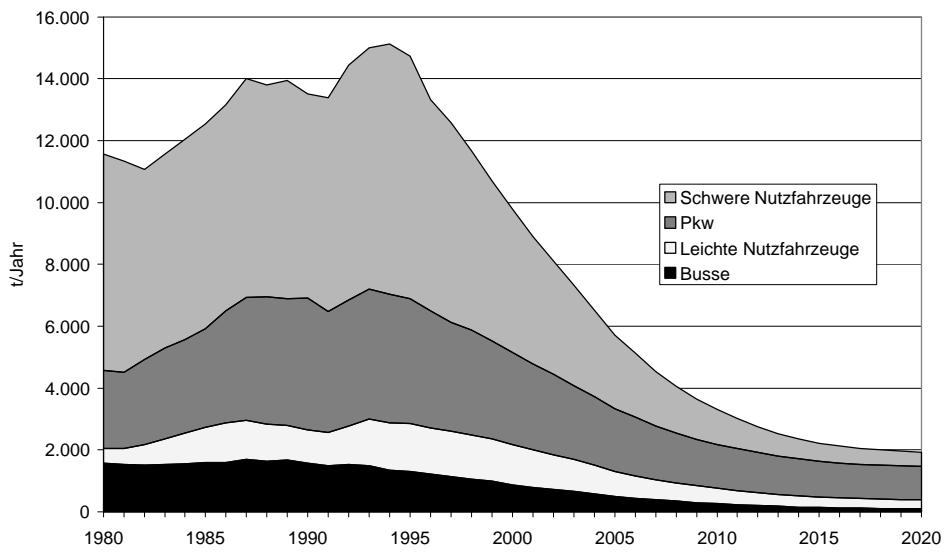


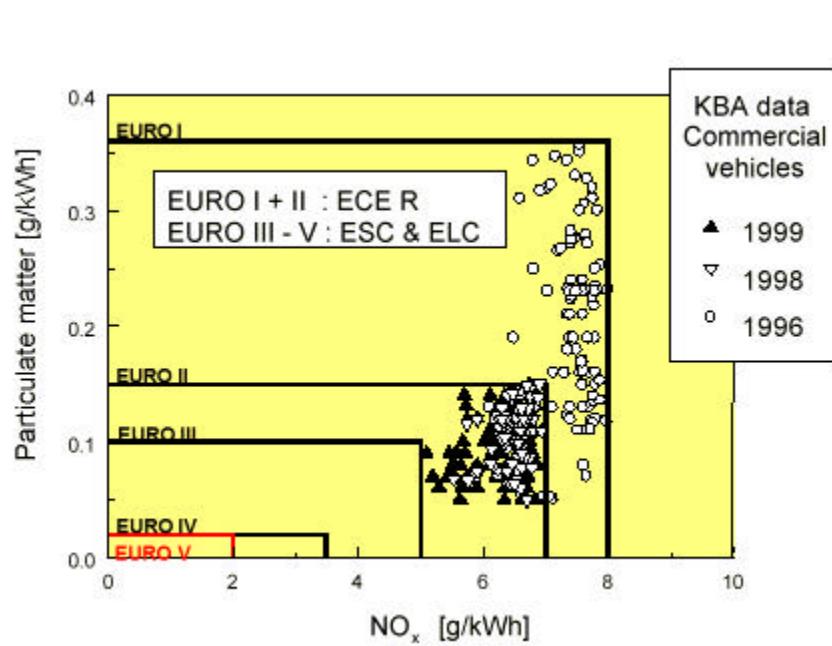
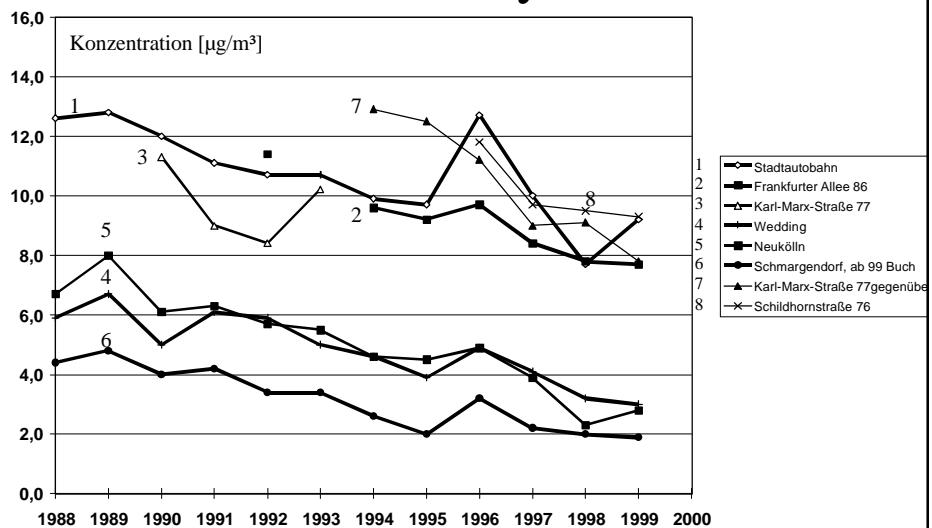
Diesel Retrofit German Perspective

Dr. Axel Friedrich
Umweltbundesamt
Berlin

Development of Vehicle Particle Emissions in Germany
(inner urban) between 1980 and 2020

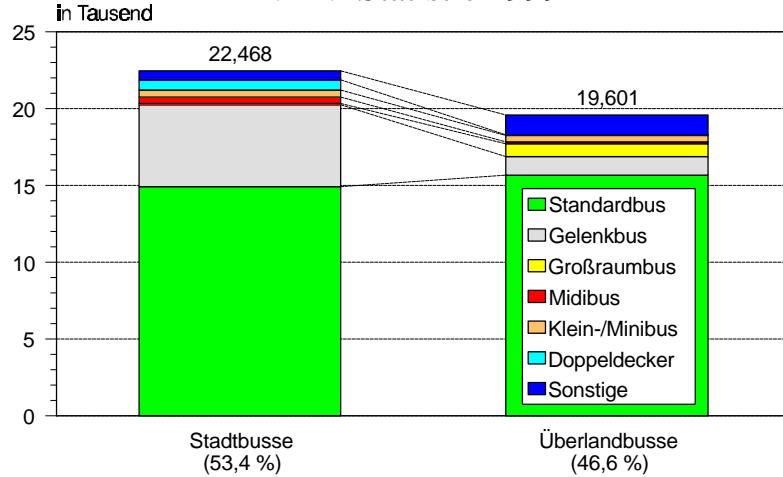


Concentration of Black Soot in Street Canyons



Number of scheduled Busses in the VDV

- VDV-Statistic 1999 -



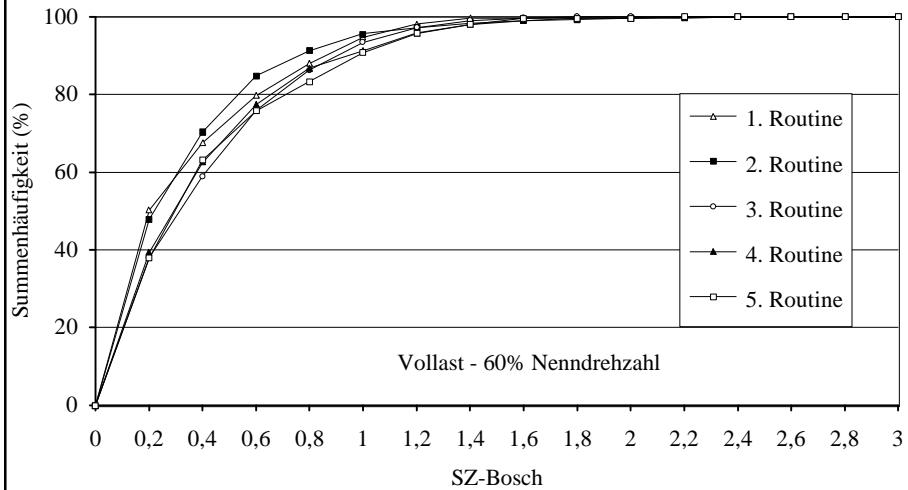
In March 1989 the Federal Ministry for Environment started a large scale Filter test

1143 trucks and busses were equipped with filters and followed the vehicles for three years in normal operations

Total government cost : 20 Million DM

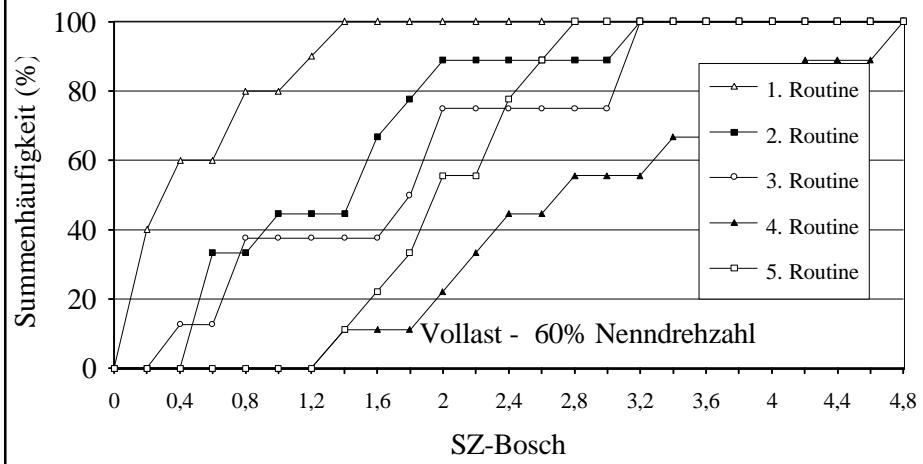
Changes of the Bosch Number

Motor-Filter-Combination Mercedes-Benz OM
427/447, 150 kW, Mann & Hummel Filter



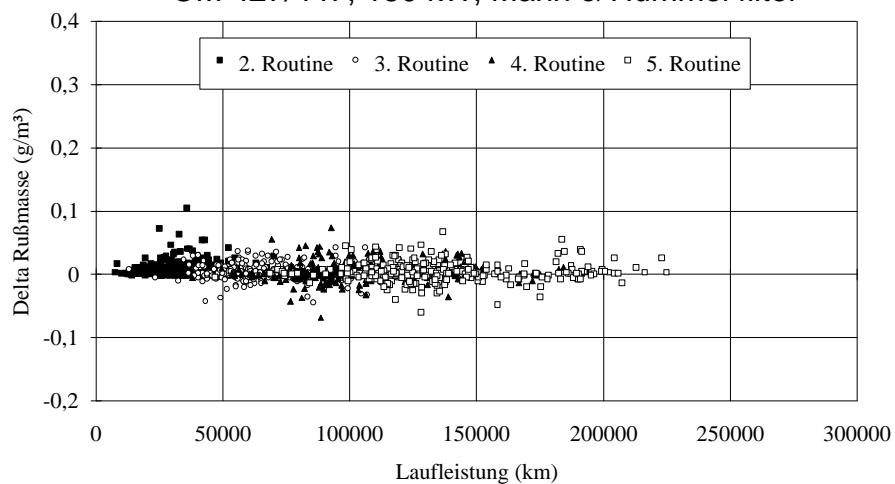
Changes of the Bosch Number

IVECO-Fiat 8120.27S, Mann & Hummel Filter
(M-F-Code 6)



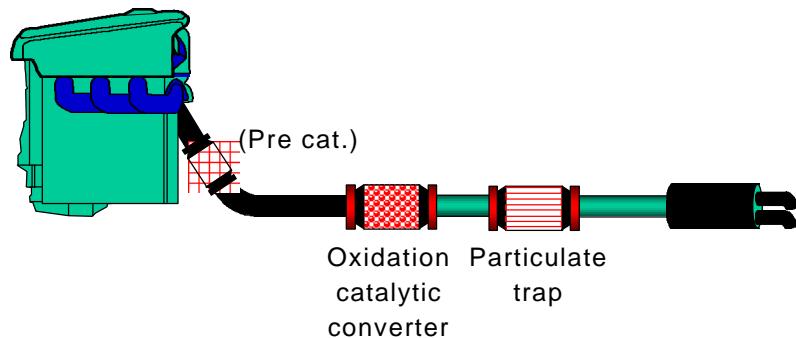
Changes of the Particle Mass Difference in g/m³ between the 1st and the following Routine Measurement

motor-filter-combination Mercedes-Benz
OM 427/447, 150 kW, Mann & Hummel filter



Exhaust gas aftertreatment for particulate

- Discontinuous systems
- Continuous systems

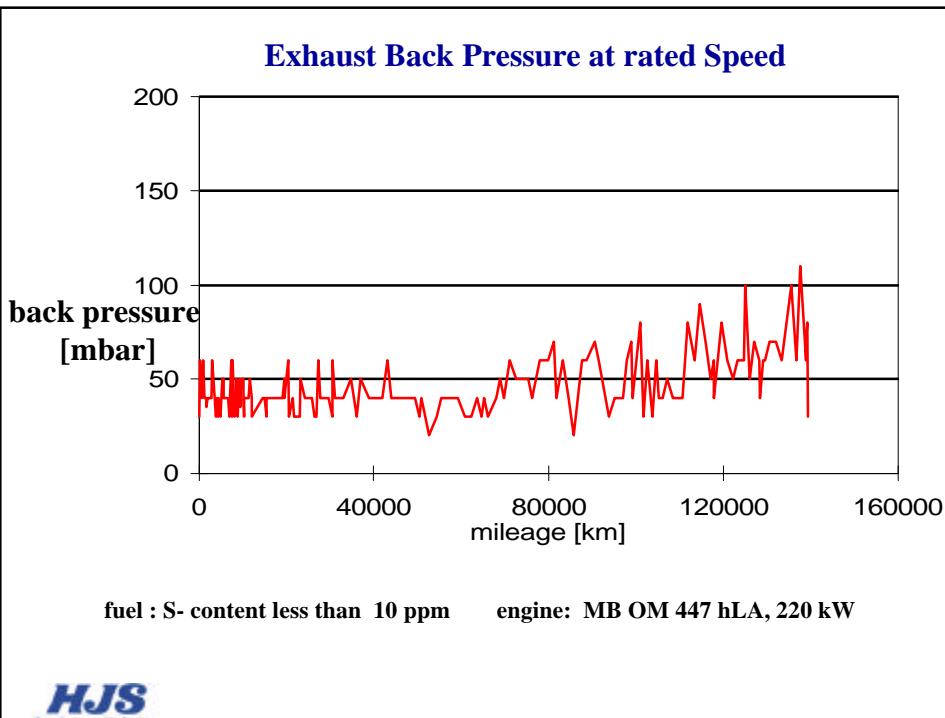


Operation Conditions for CRT Filter Systems

- sulfur free fuel with max. 10 ppm
- suitable profile
 - ⇒ temperature window from 250-450° must be reached
 - ⇒ achieved at: busses, HDV, construction machines,
- can be used with EURO I, II, and EURO III-engines

Durability Experience

- Today about 10.000 HDV in Europe with CRT filter in use
 - more than 5 years in use
 - Mileage more than 500.0000



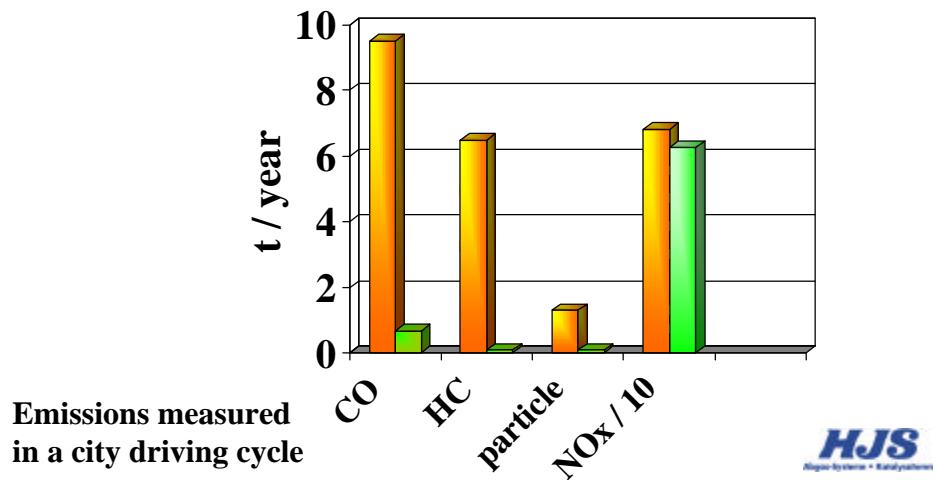
Maintenance of CRT Systems

- The filter also collects lube oil ashes
- these ashes increase in the long term the back pressure of the filter
- depending on the lube oil consumption of the engine the filter has be washed regularly
- This washing process can be made by a washing unit.
- this washing process is offered a service by HJS

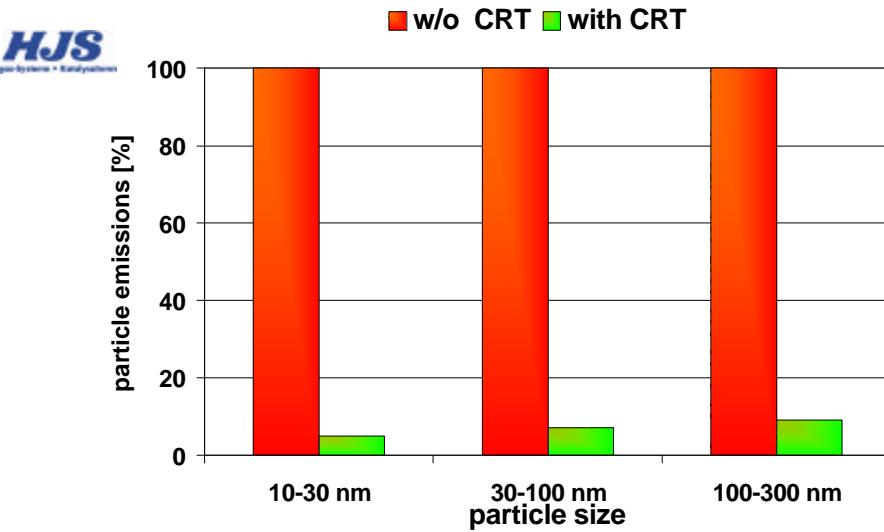


Emissions of a City Bus Fleet of 100 Euro II Vehicles w/o and with CRT

■ basis ■ with CRT

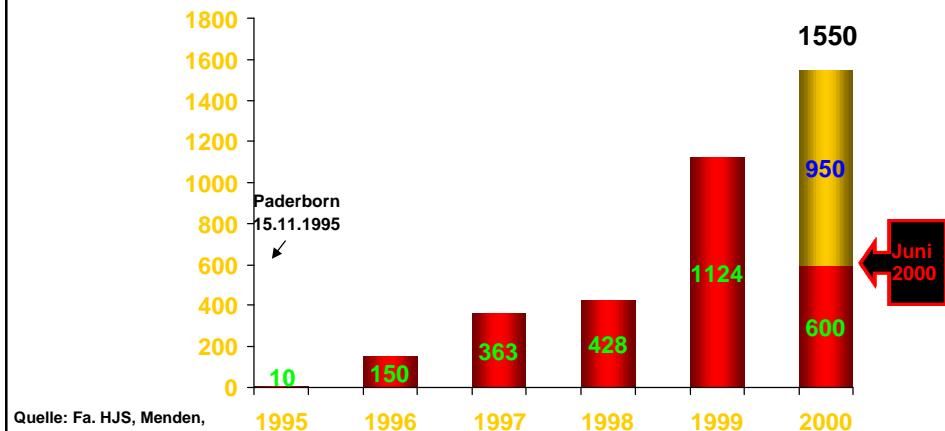


Influence of the CRT- System on the Particle Size Distribution



Yearly Additional Busses with CRT- Systems in the VDV

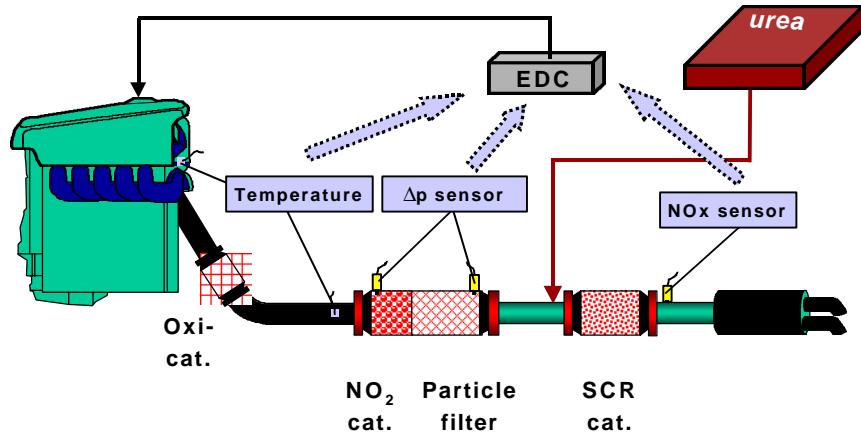
totally: 3625 Systems until End of 2000 in about 120
City Bus Companies



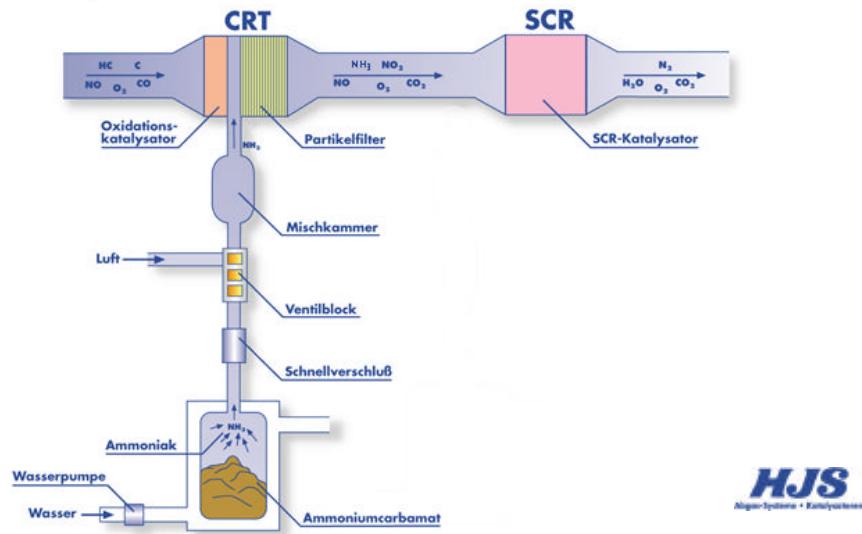
Regeneration of discontinuous Systems is supported by external Energy as Burners, Electrical Heaters, Catalysts and Additives

Requirement for additive supported systems:
No additional emissions to the environment
Only additives in combination with specific filters will be approved

exhaust aftertreatment systems for HDV
particle filter system and SCR system



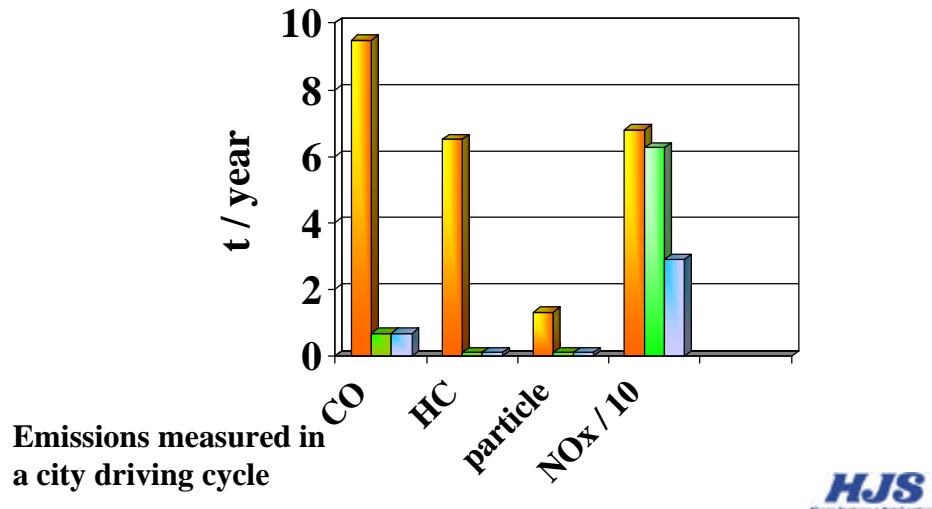
Design of the SCRT System



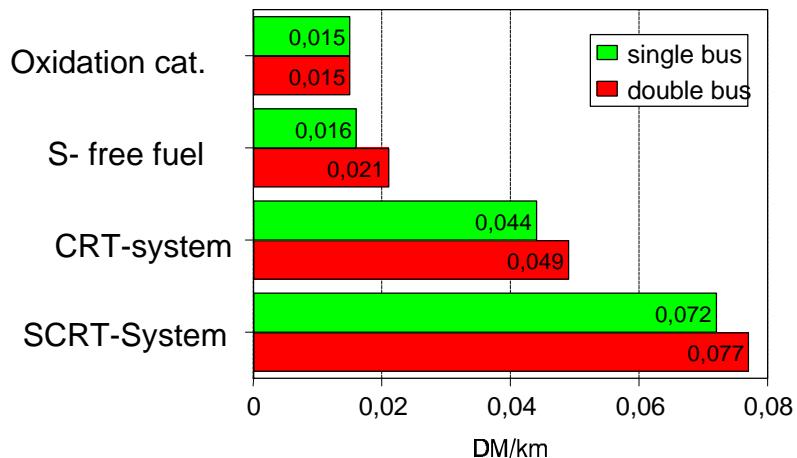
HJS
Abgas-Systeme + Katalysatoren

Emissions of a City Bus Fleet 100 Vehicles EURO II

■ basis ■ with CRT ■ with SCRT



Cost of Emission Reduction



Without a Soot Filter the Diesel Engine is unacceptable

